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PUBLIC ABSTRACT: Controls on Gas Hydrate Formation and Dissociation, Gulf of Mexico: *In Situ* Field Study with Laboratory Characterizations of Exposed and Buried Gas Hydrates

The foremost question that surrounds the occurrence of vast quantities of gas hydrate on continental margins is: "What are the potential environmental impacts of its instability in terms of the release of methane into seafloor sediments and into the ocean and atmosphere?" To answer this question, the dynamics of marine gas hydrate formation and dissociation and their impact on seafloor stability must be better understood. Areas of the seabed and ocean that are particularly at risk coincide with the phase boundaries of the gas hydrate stability field. The work proposed herein is an integrated field and laboratory scientific study that addresses this question by monitoring of the *in situ* formation and dissociation of outcropping gas hydrates and of gas hydrate-rich sediments in the northern Gulf of Mexico. The work will also characterize in detail the chemistry and structure of the hydrates, the composition of overlying seawater, and the chemistry, mineralogy, and hydrology of associated sediments and pore waters.

Preliminary short-term observations at the proposed field sites, suggest that the formation and dissociation of seafloor gas hydrate is episodic and possibly cyclic, with cycles occurring over time-scales of weeks to 2-3 months. This cyclicity is influenced by subsurface hydrology and biochemistry. Thus, the selected study sites provide an ideal location for: (1) hydrate collection, (2) controlled *in situ* experiments on the dynamics of gas hydrate formation and dissociation, and (3) monitoring methane release and local ocean environmental impacts. Important seafloor parameters that will be closely and continuously monitored are variations in methane gas flux and temperature.

This is a collaboration between M. Kastner (Scripps Institution of Oceanography) who will be in charge of the geochemical, hydrological, and sedimentological investigations and I.R. MacDonald (Texas A&M) who will oversee the field-monitoring program. The program involves sampling hydrates via submersible using specially designed pressure chambers and sampling equipment that recover gas hydrates at *in situ* P-T conditions. It also includes a continuous yearlong, seafloor, monitoring program with time-lapse camera surveillance and thermistors as well as *in situ* pore fluid sampling and measurement of pore fluid flow rates at 1-2 day resolution using an auto-flux fluid sampler (MOSQUITO). Structural, chemical, and isotopic data on the hydrates and coexisting pore waters will also be analyzed to provide new insights on the dynamics of gas hydrate formation/dissociation; the immediate environmental impacts of gas hydrate dissociation; and the sensitivity of hydrates to changes in bottom water temperature. Data collected in this study will also constrain the rate of critical methane flux through the gas hydrate reservoir.